Division of Water Supply Protection: Justification and Strategy for the Maintenance of Resistance and Resilience in the Watershed Forest through Active Forest Management

The DWSP has care and control of approximately 100,000 acres of watershed forest and deliberately manages approximately 2/3 of these acres for long term protection of drinking water. The watershed protection forest has built-in processes that, with or without active management, collectively resist change and rapidly work to recover equilibrium following a natural or deliberate disturbance. Experience has demonstrated, however, that there are opportunities to enhance these natural processes through active management. Past land management practices have had a lasting impact on Quabbin's watershed forest in the following ways:

- For many decades, the loss of natural predators and the absence of hunting by humans left deer populations as the dominating influence over the regeneration of the forest following disturbance. Deliberate management of this deer population, beginning in 1991, has restored the regeneration process, although a growing, unchecked moose population has begun to challenge it again.

- The artificial planting of several thousand acres of agricultural fields to white and red pine homogenized the age and species composition of these new forest stands, many of which were planted on sites on which they were eventually susceptible to root rot and wind throw. Removing these plantations in stages has resulted in new age classes of site-suited natural regeneration that is diverse in species composition, a generally more stable forest structure.

- With the regeneration process restored, management has moved from improvement thinnings to regeneration harvesting designed to create a mosaic of age classes across the forest that mimics the annual 0.5 to 2.0% natural disturbance cycle but in a more regulated pattern. While infrequent catastrophic disturbances will still arrive on the watershed, the forest that these will affect will include well-distributed patches of forest that are resistant to these disturbances, due to enhanced vigor or to age, size, or species diversification, or to a combination of these elements.

Other evidence from the science of forested watershed management offers additional and compelling reasons to consider active manipulation:

- Snowmelt, which generates some of the highest peak flows in a water year, is synchronized to the extent that a subwatershed's vegetation is homogenized in species or size class,; it all occurs within a single relatively narrow time period, maximizing the peak event. On the other hand, a subwatershed of mixed species composition and a variety of age classes tends toward desynchronization of snowmelt, because patches of snow gathered within differing stands will melt at different rates, resulting in a longer duration, but lower amplitude peak flow. This in turn limits bankfull stream conditions and the associated erosion of accumulated sediments and organic materials.

- Research in nutrient cycling indicates that maintaining a steady component of middle-aged stands, which provide rapid nutrient uptake through biomass accumulation, should optimize the buffering of further nutrient inputs to a watershed forests, for instance when these arrive via atmospheric deposition or the development of adjacent lands. Maintaining this forest structure requires steady recruitment of younger forest to replace middle-aged stands that have matured.

- Experimentation with a variety of silvicultural treatments on watersheds has verified the value of maintaining a mosaic of varying stand ages within the water supply protection forest, especially in the face of major natural disturbances such as hurricanes or insect infestations. As water and/or nutrients are mobilized by either cutting or natural disturbance of areas of the forest, adjacent areas of unaffected forest capture and control these releases. Attention to regeneration establishment, opening sizes, and Best Management Practices can greatly limit the mobilization of these resources from active silviculture and with careful planning, the deliberate diversification of age classes within the forest can be accomplished without impacts to the water supply. Once this diversification has been accomplished, the standing forest structure should be more capable than forests that are less diverse, of resisting and rapidly recovering from large scale, outside disturbances.

Active management carries risks that can reduce or eliminate the potential gains associated with deliberate manipulation. Current research on these risks indicates that by following a few clear rules, these risks can be controlled or eliminated:

- Researchers have shown that a minimum of 20-30% of the stocking of a forest must be cut within a short time (1-3 years) to increase water yield. Conversely, to minimize yield increases and the loss of nutrients or sediments that may accompany yield increases, managers need to limit harvesting to not more than about 25% of the stocking on a forested watershed in any given 5-10 year period.. Using GIS and GPS technologies, it has become possible to maintain these standards fairly efficiently.

- Separating the roads and staging areas from water resources is among the basic rules to protect those resources from negative impacts due to logging. Roads should be designed to minimize stream crossings and stormwater drainage structures need to be properly designed and maintained. Staging areas should be kept far enough away from water resources to be hydrologically remote.

The working strategies for actively managing the water supply protection forests under the care and control of DWSP in order to directly apply some of these principles are:

- To maintain the ability of the forest to regenerate itself.

- To annually regenerate approximately 1% of the actively managed forest, using small group selections or patch harvesting to maintain multi-age class structure and diverse species composition.

- To strictly adhere to Conservation Management Practices that have been customized for drinking water supply protection.

- To limit harvesting to no more than 25% of the stocking of any given subwatershed during any given 10 year period.

- To further limit harvesting based on three major zones within the watersheds

    - Zone 1 includes the buffer strips along public roads, the variable width filter strip along streams and water bodies, the DWSP filter strips around all vernal pools, and all other land that is within 200 feet of the bank of tributaries to the reservoirs or within 400 feet of the bank of the reservoirs themselves.
    - Zone 2 is a specific half-mile protection zone surrounding the intakes
    - Zone 3 is the remainder of the property